CLAIMS

We claim:

1. A multiplexer, comprising:

a filter, positioned to receive an optical signal from each of a plurality of optical transmission lines and capable of combining said optical signals into a multiplexed signal;

a semiconductor optical amplifier, positioned to receive said multiplexed signal from said filter and capable of amplifying said multiplexed signal.

2. The multiplexer of claim 1, wherein said filter is an array waveguide grating.

3. The multiplexer of claim 1, wherein said filter is a thin film filter.

4. The multiplexer of claim 1, wherein said filter is a Bragg grating.

5. The multiplexer of claim 1, wherein said filter is a bulk grating device.

6. The multiplexer of Claim 1, wherein said filter and said semiconductor optical amplifier are combined on a single integrated circuit chip.

7. The multiplexer of Claim 1, wherein said semiconductor optical amplifier substantially compensates for optical losses in the filter.

8. A demultiplexer, comprising:

a semiconductor optical amplifier, positioned to receive a multiplexed signal from a multiplexed signal transmission line and capable of amplifying said multiplexed signal to produce an amplified multiplexed signal; and

a filter, positioned to received said amplified multiplexed signal from said semiconductor optical amplifier and capable of splitting said amplified multiplexed signal into a plurality of optical signals, each of said optical signals having a different wavelength.

9. The demultiplexer of claim 8, wherein said filter is an array waveguide grating.

10. The demultiplexer of claim 8, wherein said filter is a thin film filter.

11. The demultiplexer of claim 8, wherein said filter is a Bragg grating.

12. The demultiplexer of claim 8, wherein said filter is a bulk grating device.\

13. The demultiplexer of Claim 8, wherein said filter and said amplifier are combined on a single integrated chip.

14. A multiplexer, comprising:

a substrate;

a filter, located on said substrate, capable of receiving a plurality of optical signals and capable of combining said optical signals in a multiplexed signal;

a semiconductor optical amplifier, located on said substrate and positioned to receive said multiplexed signal from said filter, said semiconductor optical amplifier capable of amplifying said multiplexed signal.

15. The multiplexer of claim 14 wherein said substrate is silicon.

16. The multiplexer of claim 14 wherein said substrate is silica glass.

17. A demultiplexer, comprising:

a substrate;

a semiconductor optical amplifier, located on said substrate and positioned to receive a multiplexed signal, said semiconductor optical amplifier capable of amplifying said multiplexed signal to produce an amplified multiplexed signal; and

a filter, located on said substrate, positioned to receive said amplified multiplexed signal, said filter capable of splitting said amplified multiplexed signal into a plurality of optical signals, each of said optical signals comprising a different wavelength.

18. The demultiplexer of claim 17 wherein said substrate is silicon.

19. The demultiplexer of claim 17 wherein said substrate is silica glass.

20. A multiplexer/ demultiplexer module, comprising:

a first filter, positioned to receive an optical signal from each of a plurality of optical transmission lines and capable of combining said optical signals in a multiplexed signal;

a semiconductor optical amplifier, positioned to receive said multiplexed signal from said first filter and capable of amplifying said multiplexed signal to produce an amplified multiplexed signal;

a second filter, positioned to received said amplified multiplexed signal from said semiconductor optical amplifier and capable of splitting said amplified multiplexed signal into a plurality of optical signals, each of said optical signals comprising a different wavelength.

21. The module of claim 20, wherein at least one of said first filter and said second filter is an array waveguide grating.

22. The module of claim 20, wherein at least one of said first filter and said second filter is a thin film filter.

23. The module of claim 20, wherein at least one of said first filter and said second filter is a Bragg grating.

26. The module of claim 20, wherein at least one of said first filter and said second filter is a bulk grating device.

27. The module of Claim 20, wherein the amplifier is included on a single integrated circuit with at least one of said first filter and said second filter.

28. The module of Claim 20, wherein the amplifier substantially compensates for the losses in the first filter and the second filter.

29. A method of multiplexing a plurality of optical signals, said method comprising:

providing a plurality of optical signals;

combining said optical signals to produce a multiplexed signal; and

amplifying said multiplexed signal with a semiconductor optical amplifier.

30. The method of claim 29, wherein combining said optical signals is accomplished with an array waveguide grating.

31. A method of demultiplexing a multiplexed signal, said method comprising:

providing a multiplexed signal;

producing an amplified multiplexed signal by amplifying said multiplexed signal using a semiconductor optical amplifier; and

filtering said amplified multiplexed signal to produce a plurality of optical signals, wherein each of said plurality of said optical signals comprises a different wavelength.

32. The method of claim 31, wherein filtering said amplified multiplexed signal is accomplished with an array waveguide grating.

33. A method of multiplexing and demultiplexing a plurality of optical signals, said method comprising:

providing a plurality of optical signals;

combining said plurality of optical signals to produce a multiplexed signal;

producing an amplified multiplexed signal by amplifying said multiplexed signal with a semiconductor optical amplifier; and

filtering said amplified multiplexed signal to produce a plurality of optical signals, wherein each of said plurality of said optical signals comprises a different wavelength.

34. The method of claim 33, wherein combining said plurality of optical signals is accomplished with an array waveguide grating.

35. The method of claim 33, wherein filtering said amplified multiplexed signal is accomplished with an array waveguide grating.